

STATUS OF THE DELCO SYSTEMS OPERATIONS

FORWARD LOOKING WINDSHEAR DETECTION PROGRAM

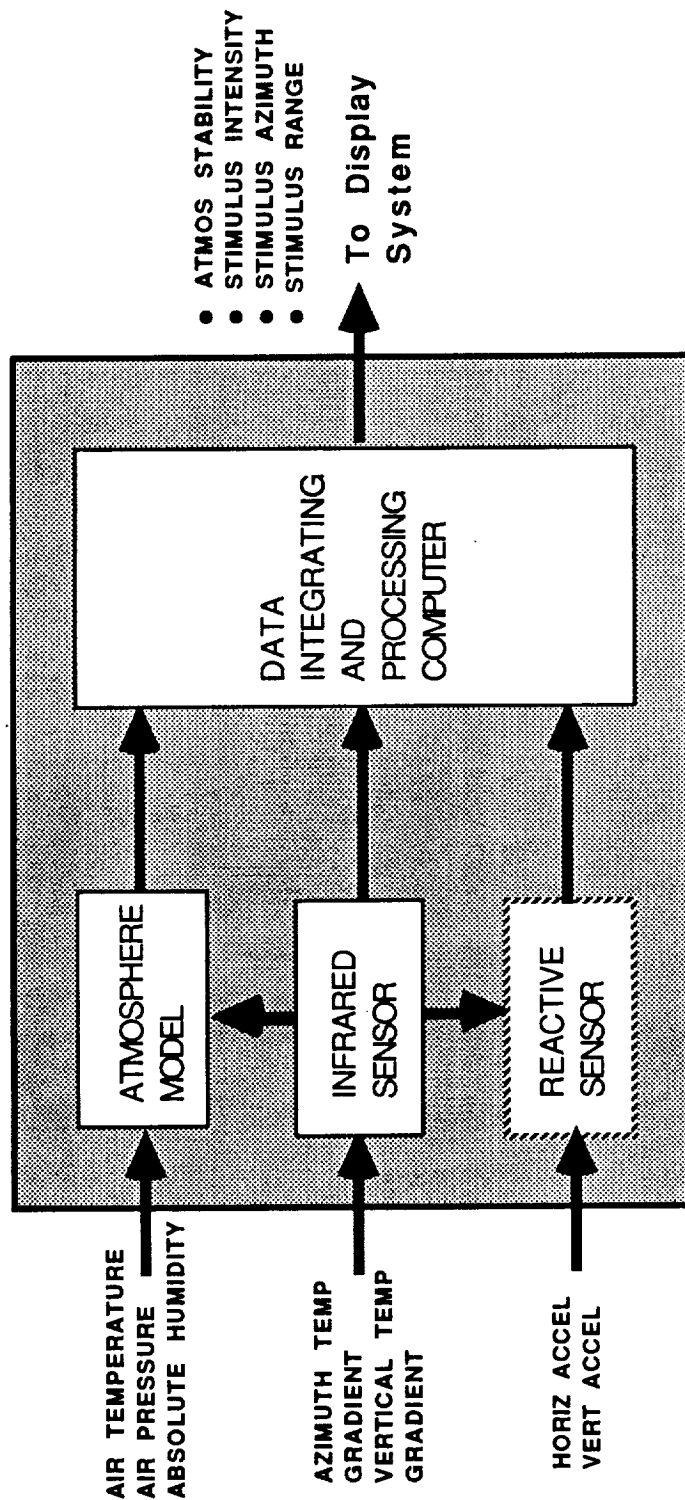
Brian J. Gallagher
Delco Systems Operations
Milwaukee, Wisconsin 53201

ABSTRACT

Delco Systems Operations, a division of General Motors Hughes Electronics Corporation, is developing a Forward Looking Windshear Detection System based on the integration of infrared remote sensing and accelerometer reactive sensing technologies. The IR sensor is a multi-spectral, scanning radiometer operating in the 8 to 14 micron region. A 2 x 5 detector array with parallel-serial scanning produces 60 degrees horizontal and 10 degrees vertical-fields of view. Using multiple wavelength signals, azimuth temperature gradients are analysed for characteristic signatures of thermally induced windshear phenomena. Elevation temperature gradients are processed through an atmosphere model to continuously compute a stability index for arming microburst detection criteria. The atmosphere model and proprietary computer processing algorithms combine to generate coarse estimates of disturbance ranges based on multiple wavelength radiance data with different extinction coefficients. Computer outputs of atmospheric stability, disturbance intensity, and azimuth and range information provide a situation display capability. A ground operated, experimental radiometer has been developed and is being used to verify our detection and discrimination concepts at an atmospheric and simulated rain test facility in Milwaukee. A prototype airborne radiometer is being developed for flight test evaluation during the summer of 1989.

DELCO SYSTEMS OPERATIONS

FORWARD LOOKING WINDSHEAR DETECTION SYSTEM



System Functional Diagram

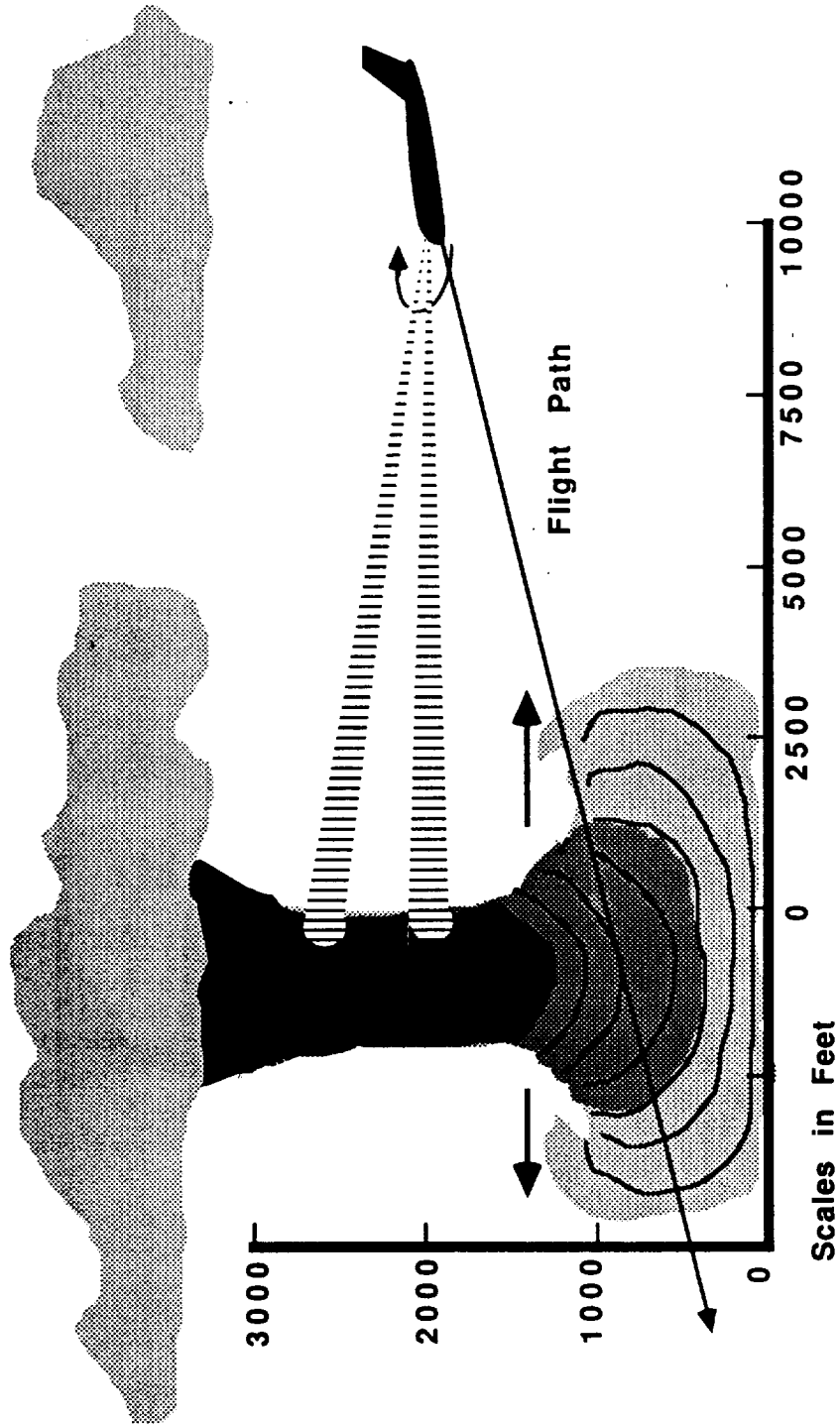
FORWARD LOOKING WINDSHEAR DETECTION SYSTEM

INFRARED SENSOR

- Passive, Multi-spectral, Scanning Radiometer
 - Far IR Spectral Region (8 - 14 microns)
 - 2 x 5 Detector Array
 - Parallel-Serial Scanning
 - Sliding, 3/5 Operating Wavelengths
 - 60° Horizontal Field of View
 - 10° Vertical Field of View
- Volume: < 200 cubic inches
- Weight: < 10 pounds
- Power: < 100 watts

DELCO SYSTEMS OPERATIONS

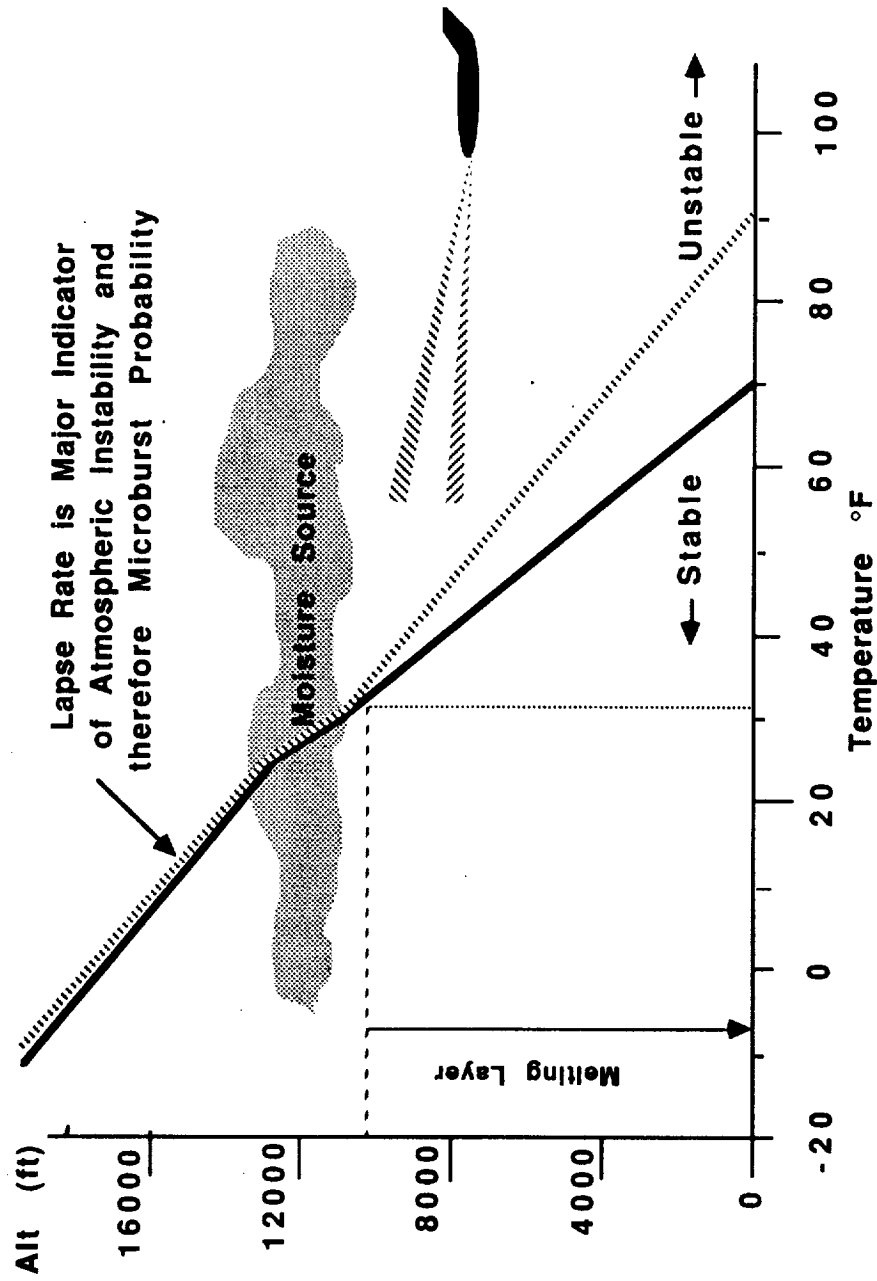
FORWARD LOOKING WINDSHEAR DETECTION SYSTEM



Infrared Detection of Microbursts

DELCO SYSTEMS OPERATIONS

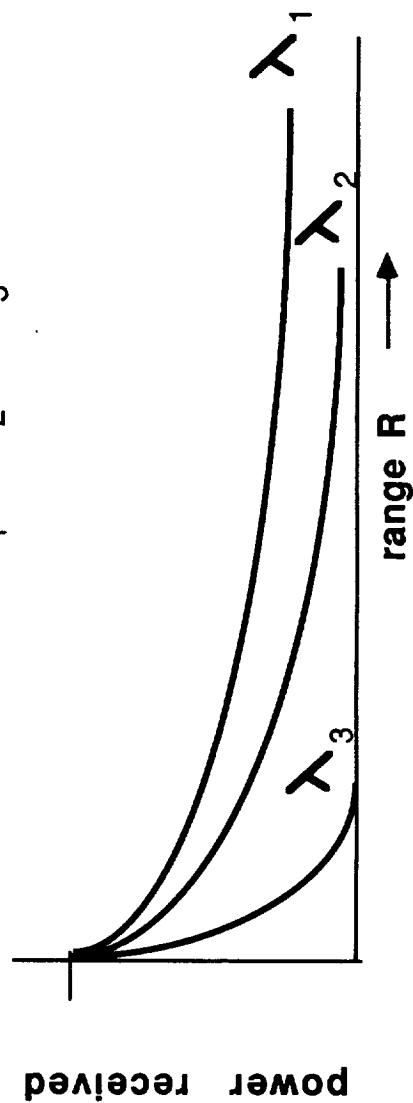
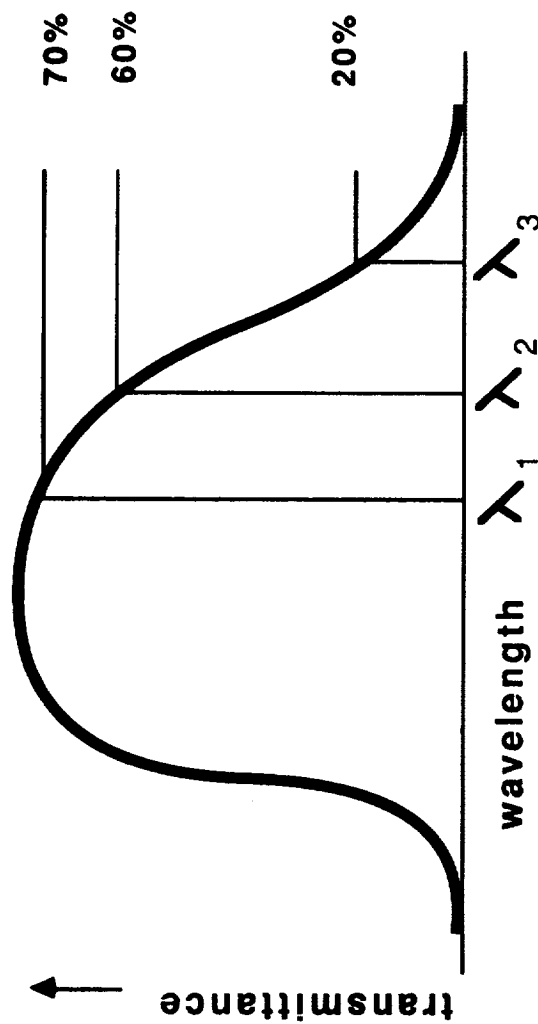
FORWARD LOOKING WINDSHEAR DETECTION SYSTEM



Lapse Rate and Atmospheric Stability

DELCO SYSTEMS OPERATIONS

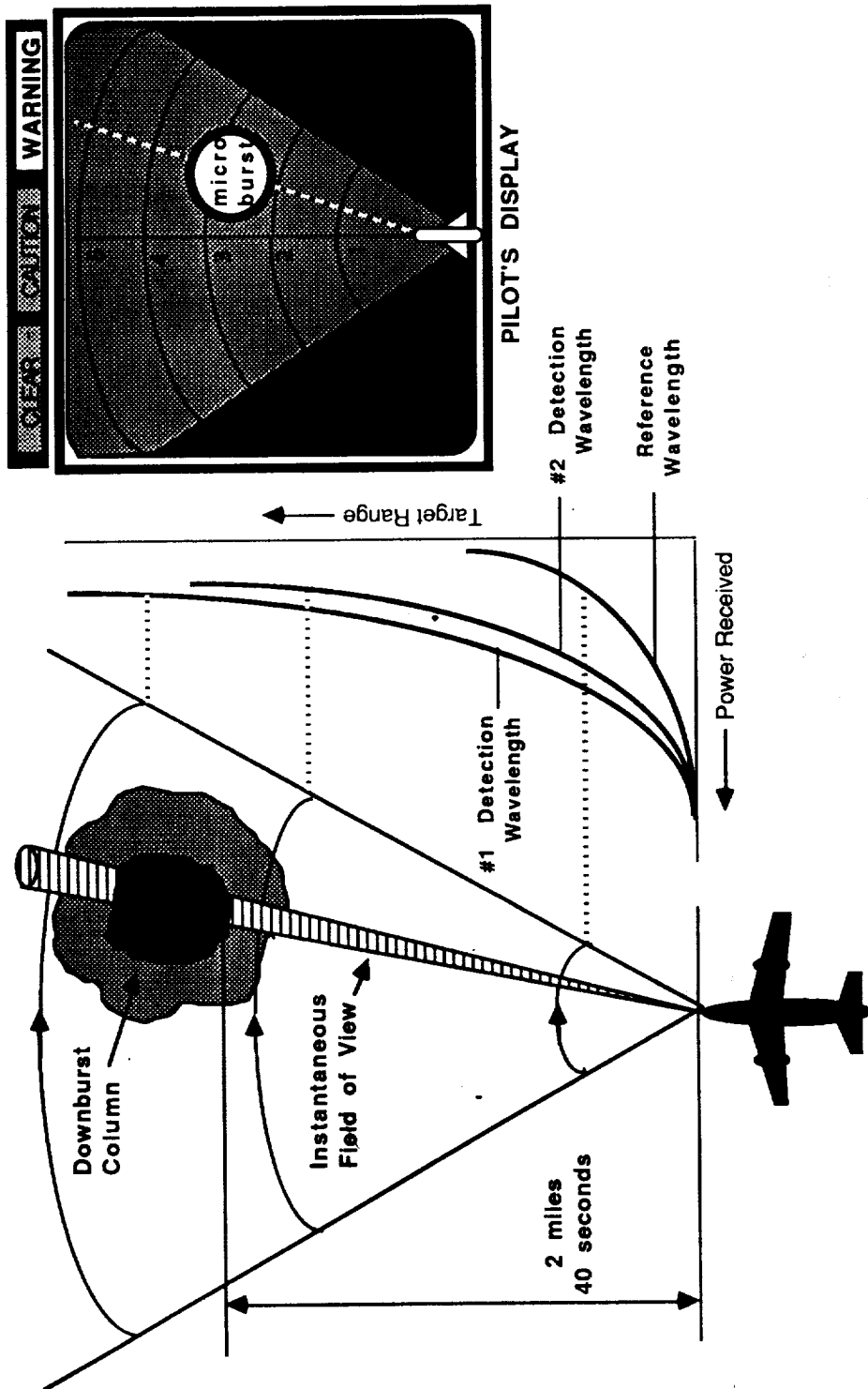
FORWARD LOOKING WINDSHEAR DETECTION SYSTEM



Range Sensitivity of Operating Wavelength

DELCO SYSTEMS OPERATIONS

FORWARD LOOKING WINDSHEAR DETECTION SYSTEM



Detection and Display System Operation

ORIGINAL PAGE
BLACK AND WHITE PHOTOGRAPH



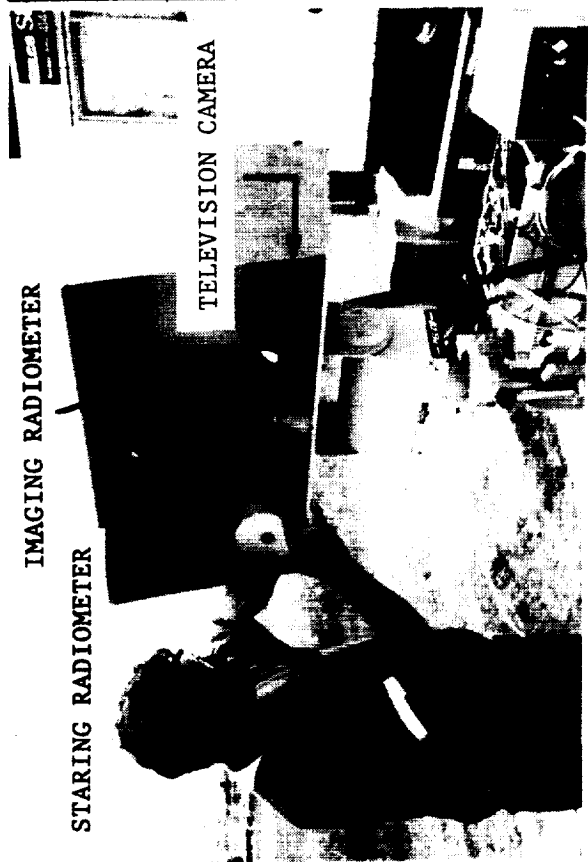
ATMOSPHERIC TESTING RANGE SITE

ORIGINAL PAGE
BLACK AND WHITE PHOTOGRAPH



IMAGING RADIOMETER

STARING RADIOMETER



TELEVISION CAMERA



EXPERIMENTAL RADIOMETER TEST SETUP

ORIGINAL PAGE
BLACK AND WHITE PHOTOGRAPH



SPRAY SYSTEM, EXPERIMENTAL RADIOMETER,
& EQUIPMENT TRAILER

ORIGINAL PAGE
BLACK AND WHITE PHOTOGRAPH



PUMPING AND CONTROLS SYSTEM

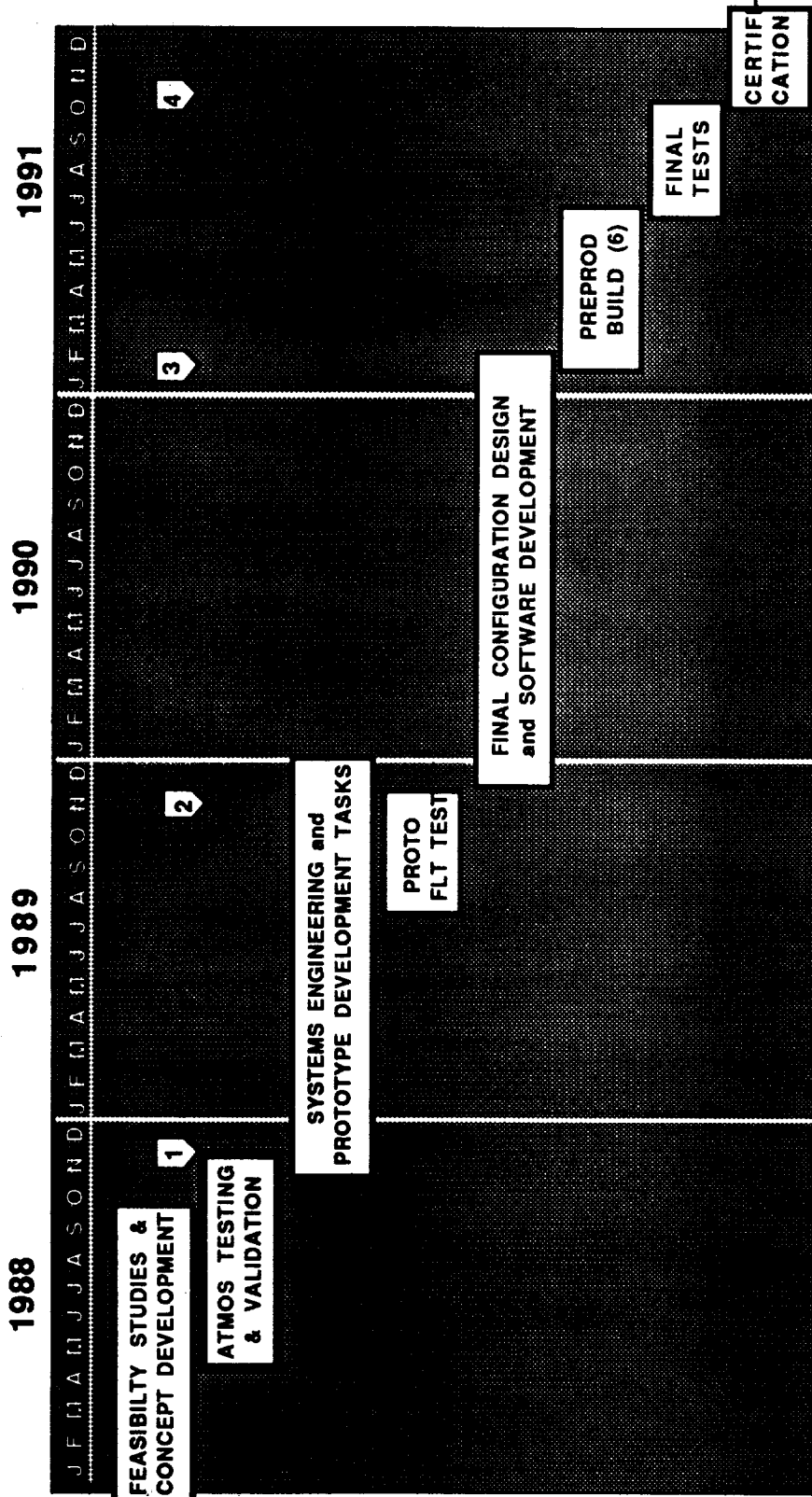
BLACK AND WHITE PHOTOGRAPH



SPRAY SYSTEM IN OPERATION

DELCO SYSTEMS OPERATIONS

FORWARD LOOKING WINDSHEAR DETECTION PROGRAM



Program Schedule

DELCO SYSTEMS OPERATIONS

FORWARD LOOKING WINDSHEAR DETECTION SYSTEM

STATUS

- FEASIBILITY STUDY COMPLETE
- ATMOSPHERIC TESTING PROGRAM
 - Data Collection completed
 - Data Analysis in Progress
- PROTOTYPE SYSTEM DEVELOPMENT
 - Airborne IR Sensor to be flight tested summer 1989

WIND SHEAR TEST SETUP

